tropical air mass, on the other hand, is of marine origin, and is thus relatively warm, light, and near the saturation point.

Since no consistent temperature data exist for the area over the ocean, neither the location of the front nor the identity of the air masses can be predicted with the same degree of certainty. If, on the other hand, the mean position of the polar front is correct in its western reaches, there is no logical reason to assume that the front would be displaced equatorward in its eastern extension.

What has been attempted, and illustrated in figure 5, is essentially a revision of the Norwegian map on the ground that the establishment of a front from a deformation field, regardless of how clearly that field exists on the mean pressure map for February, is contrary to the facts revealed by actual observational data.

As previously mentioned, the discrepancies in the location of the Pacific Arctic front are slight. It is generally agreed that there exists in this region a distinct zone of frontogenesis and cyclonic degeneration. The explanation of this seeming paradox is that cyclones which are dying out after occlusion are often regenerated when fresh air masses are brought into them. The mean position of this front has been derived in the same manner as that of the Pacific polar front. The results thus obtained were checked with Werenskiold's [9] maps of mean monthly air transport, and strong agreement was found to exist between his lines of air convergence and the mean path of storms. The designations of the air masses (fig. 5) were derived principally from the synoptic weather maps of the California Institute of Technology and from Byers' [10] paper. According to these sources of information it is inferred that polar continental air, flowing out through the larger river valleys of Alaska, converges with N_{PPM} or N_{PC} air which has crossed the North Pacific.

[9] Werenskiold, W., Mean Monthly Air Transport Over the North Pacific Ocean, Geofysiske Publikationer, v. 2, no. 9, 1922.
[10] Op. cit., 322.

INFLUENCE OF LAKE PONCHARTRAIN ON FOG FORMATION AT SHUSHAN AIRPORT, NEW ORLEANS, LA.

By GEORGE V. FISH

[Weather Bureau, New Orleans, March 1936]

The importance of fog as a hazard to the operation of aircraft has been an incentive to study and analyze the various conditions which favor its formation. These studies, particularly those by Willett (Synoptic Studies in Fog, M. I. T. Meteorological Papers, 1930), have added much to current knowledge, and are the basis upon which the increasingly accurate forecasts of fog conditions are made by the United States Weather Bureau airway district forecast centers; to add further a knowledge of factors which have a direct bearing on particular local situations should prove of value to forecasters, particularly where an important air terminal is involved.

Shushan Airport, at New Orleans, La., is constructed on dredged land, inclosed by a concrete sea wall, on what formerly was a portion of the bottom of Lake Ponchartrain. The airport extends out into the lake in the shape of a blunt arrowhead, with facilities for both land and sea planes. The fill was completed to an average height of approximately 6 feet above water level. Lake Ponchartrain is classified as salt water; there is often a definite tidal influx which, however, is probably more than counterbalanced by the outflow from numerous fresh-water bayous which empty into Ponchartrain, so that the introduction of warm water from the Gulf of Mexico is confined to a very small section.

At its widest point, in a north-south direction, Lake Ponchartrain is about 25 miles across; roughly pear-shaped, it is approximately 40 miles along the east-west axis. Shushan Airport is on the south shore of the lake, near the point where it is widest. To the eastward, Lake Ponchartrain empties into Lake Borgne, another body of salt water, which is influenced to a greater extent by tides from the Gulf of Mexico.

The surrounding terrain is level delta land for many miles, not varying more than a few feet in elevation except for the levee works along the river and canals. The only impediments to the free flow of air along the level surface from all directions are the comparatively narrow strip of timber to the southeast and the city of New Orleans to the southwest. To the northwest, north, and northeast, nothing bars the free flow of air from off the lake. It is because of this circumstance that rapid changes in visibility and, less often, in ceiling, are sometimes observed.

From a knowledge of the changes that are known to occur in oceanic surface water temperatures, it may be assumed that marked changes in temperature occur seasonally in Lake Ponchartrain, and that these changes may sometimes be greatly intensified during a comparatively brief period.

McDonald (Seasonal Variations in North Atlantic Surface Temperatures, Trans. Am. Geophysical Union, 1935), using some material compiled by Schott, and supplementing it from data in the files of the Marine Division of the United States Weather Bureau, has shown that the annual range of surface water temperatures in the Gulf of Mexico in close proximity to Lake Pontchartrain is slightly more than 20° F. His investigation led him to the conclusion that "Intensified local cooling of a portion of the ocean surface occurs more readily than local warming."

If we may apply this conclusion here, which appears reasonable, and make further allowance for increased cooling due to closer proximity to the sources of extremely cold polar air, and for the fact that little if any warmer water is introduced by tidal action, we may assume that the surface waters of Lake Pontchartrain cool very rapidly with the coming of the winter season; and after a particularly severe cold wave, they may be further cooled, until a large difference in temperature exists between a mass of warm moist air advancing inland from the Gulf of Mexico, and the surface of Lake Pontchartrain.

The change from cold continental air to warm Gulf air usually is rapid. Since the surface waters of the lake respond more quickly to cooling processes than to warming, the difference in temperature between the water surface and the warm air mass will not be appreciably diminished during the average time required for translation of warm-air masses across the lake surface. During the period of translation, surface cooling of the air mass takes place, and surface fog over the lake normally results.

The formation of this surface fog may partially explain why surface cooling takes place more readily than surface

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warming; the formation of the surface fog largely prevents warming by insolation. The condition, by observation, tends to persist as long as the warm-air mass overlies the water, which may be only a matter of a few hours but can, under extremely stagnant conditions, persist for a day or more.

The layer of fog tends to disappear as it reaches and passes over the airport; but it can become a real hazard to the landing of aircraft when it is particularly dense, under special conditions. It is not often that the winds drift the fog in over the airport, since the field is on the south shore and the fog is most likely to form while southerly winds prevail; but when there is little pressure gradient, variable winds due to local temperature differences between the cold water and the warmer adjacent land may cause a slow landward drift to set in, which brings the fog over the airport.

When the wind is fresh, fog is not observed; with a moderate to fresh wind it may form, but seldom is a hazard, since at such times the circulation is so well controlled by pressure gradient that local effects are overcome. With light to moderate winds, the fog is almost invariably present over the lake during otherwise favorable conditions, appearing to an observer as a whitish gray roll of vapor at a distance that varies with (1) the wind velocity; (2) the moisture content of the overlying air mass; (3) the difference in temperature between the latter and the water surface.

The depth of the fog varies from a few feet, when it is barely distinguishable, to probably more than 100 feet under extreme conditions. At times the top of the layer presents a billowy appearance as the shifting variable winds bring about changes in the direction of drift, but the top of the layer is usually about level.

As the fog drifts in over the airport, if it persists long enough to reach the south side of the field (where the lake shore used to be) and passes out over the level country beyond, the barrier formed by the administration building and the two large hangars (one on each side of the administration building) gives rise to a peculiar condition to the south, with no fog over the area to the leeward of the buildings, while on either side the fog flows on with the surface currents drifting inland.

TROPICAL DISTURBANCES, JUNE 1936

By I. R. TANNEHILL

[Weather Bureau, Washington, July 1936]

June 11–17.—This disturbance, the first of the season, was in evidence in the radio reports on June 11; in the extreme northwestern Caribbean Sea, pressure was below normal with some indications of a cyclonic wind system in the Gulf of Honduras. The reports at hand do not show more definite cyclonic development until 8 p. m. E. S. T., of June 12, when the center was near the northeastern tip of Yucatan. The report from Cozumel Island gave pressure 29.56 inches, wind northwest, light. The disturbance was then moving toward the north-northwest. After passing into the Gulf of Mexico it turned to the northeastward.

The center crossed the Florida Gulf coast about 20 miles south of Fort Myers at 1 a. m., E. S. T., on June 15. During the 15th its course lay slightly south of east across Florida. The center passed directly over Miami with a lull in the wind from 8:03 a. m. to 8:23 a. m. of the 15th.

At 3 a.m., E. S. T., of June 16, the S. S. *Mayari*, at about 26° N., 73° W., reported wind west, force 8, lowest barometer reading (2 a.m.) 29.57 inches.

The center of the disturbance was located at about 30½° N., 69½° W., at 7 a.m. of the 16th. Twelve hours later it was a short distance northwest of Bermuda, where the barometer read 29.48 inches with wind south, force 8. The rate of progressive movement of the disturbance on the 16th and late on the 15th was rapid.

At no time in its history is this disturbance known to have been of hurricane intensity. The highest wind velocity at Miami was 39 miles an hour from the northeast. Wind velocities of 30 to 40 miles an hour were estimated at points elsewhere on the mainland of extreme southern Florida. No extensive damage was caused by the winds. There were torrential rains of 8 to 15 inches in some places in southern Florida, flooding highways and lowlands and causing much inconvenience and some damage. There was some loss of livestock from drowning. A Coast Guard airplane while in search of small boats, fell in Tampa Bay on the morning of June 15 and three Coast Guard employees in the plane lost their lives.

The first advisory message was issued at 9:30 p. m., E. S. T., on June 12 and timely advices were continued at frequent intervals thereafter until the disturbance had passed well to the northeastward of Bermuda on the 17th. Storm warnings were widely disseminated in southern and western Florida on the morning of the 14th, nearly 24 hours before the center of the disturbance crossed the southern part of the State.

It is worthy of note that on June 8 and 9, just prior to the appearance of the disturbance in the Bay of Honduras, a tropical cyclone was reported in the Pacific Ocean off Guatemala. At 9:30 p. m. (local time) of the 8th the S. S. *Nordhval*, at about 13°45′ N., 94°30′ W., experienced increasing northeast winds. On the 9th when at approximately 13° N., 93° W., she reported east-southeast winds, force 9, barometer 29.18 inches (uncorrected). The wind then shifted to SE. and S., force 10, then to SSW., diminishing. This and other reports indicate that this cyclone was moving northeastward toward the coast of Guatemala on the 8th and 9th. While there are no further ship reports in the Pacific that connect this storm directly with the disturbance which appeared on the 11th in the Bay of Honduras yet there were heavy rains on the 9th and 01th in Yucatan, and British Honduras, with pressure and wind changes that indicate that this disturbance crossed to the Caribbean Sea.

June 18–21.—On June 18 squally weather was reported a short distance north of Yucatan without, however, any definite cyclonic circulation. Radio reports on the 19th indicated the presence of a tropical disturbance to the northwest of Yucatan. The disturbance moved in a northwesterly direction until the evening of June 20, when it was located approximately at 25° N., 95° W., after which it turned toward the southwest, crossing the Mexican coast between Brownsville and Tampico, probably near Sota la Marina.

There are no reports to indicate that this disturbance attained more than moderate intensity. The steamship *Louisiane* encountered the storm on the 20th and 21st and experienced wind force 8 from the north-northwest